

Curriculum Vitae

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Abstract

Title of Thesis: The influence of various demographic and social factors on patient perceptions regarding orthodontic treatment

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While orthodontic patients previously received information about their treatment primarily through their orthodontist, there may now be a shift in the way in which patients obtain information, as well as in the information that they receive. This study sought to determine how much patients knew about manufacturer's claims of alternative orthodontic treatments and their level of positivity towards those treatments. The manufacturer's claims studied were those made by Align Technologies (Invisalign[®]), Ormco (Damon[®]), and DenMat Holdings (Six Month Smiles[®] and Snap-On Smile[®]). The demographic variables studied were gender, age, ethnicity, and place of care. To determine these differences in perception, a survey was designed and distributed to patients, age 14-50, who presented for an initial appointment at either the University of Maryland Dental School Orthodontic Clinic or at private practices in the Baltimore/Washington, D.C. area. One hundred and thirty-one surveys were completed over a four month period. Differences in demographic variables between those patients seeking care at the Dental School versus private practice were analyzed using chi-square and Fisher's exact tests. ANOVA and Kruskal-Wallis ANOVA were used to compare (a)

knowledge of manufacturer's claims in general, (b) knowledge of Invisalign's® claims specifically, and (c) the desirability of Invisalign® for patients with the following variables: gender, age, ethnicity, and place of care (either the Dental School or private practices). Differences were found between patients seeking care at the Dental School versus patients seeking care in private practice for the following variables: ethnicity; chief complaint; and the number of magazines read. We also found that patients age 14-18 had less knowledge of Invisalign's® claims and thought Invisalign® was less desirable than patients age 19-30 or 31-50.

The influence of various demographic and social factors on patient perceptions regarding
orthodontic treatment

by

Lauren E. Widmer

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, Baltimore in partial fulfillment
of the requirements for the degree of
Master of Science
2014

Acknowledgements

My Thesis Committee, for their wonderful mentorship:

Dr. Robert Williams

Dr. Elaine Romberg

Dr. Monica Schneider

Dr. Glenn Minah

For all her help with our data collection:

Ms. Bela Saini Bernstein

The University of Maryland Dental School front desk who distributed our survey instrument:

Ms. Raykeisha Briscoe

Ms. Kristen Revty

Ms. Deborah Thalwitzer

Private practice offices in the Baltimore/Washington, D.C. area who distributed our survey instrument:

Dr. Thomas Barron

Dr. Byron Bonebreak

Dr. David Harmon

Drs. Raj and Tarun Saini

Dr. Viney Saini

Dr. Edgar Sweren

Dr. Robert Williams

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INTRODUCTION

Traditionally, orthodontists have been able to develop a productive, successful orthodontic practice based on referrals from general dentists or from their own current patients (Bellavia, 1986). Further practice growth was supplemented through community involvement, insurance company referrals, and/or advertising by the practitioner (Bellavia, 1986). With the growing prevalence of the internet and other media venues, the sources of patient referrals and their perceptions of care may be shifting. Social factors may have an impact on patient perceptions of care, and an astute orthodontist should know what information patients are receiving and how they are receiving it (Internet World Stats, 2011).

This study sought to determine the influence of various demographic and social factors on patient perceptions regarding orthodontic treatment. It is important for orthodontists and other dental professionals to know how orthodontic treatment is perceived by patients in order to more effectively communicate treatment options to their patient.

LITERATURE REVIEW

In all professions, providers of goods or services must compete for consumers. Marketing allows providers to present their products or services to the public, encouraging potential consumers to consider the options that the provider is rendering. Marketing objectives include creating, delivering, communicating, and exchanging products or services that have value for clients, customers, and society at large (American Marketing Association, 2012). Orthodontics, which may be considered a nonessential service, must utilize marketing to compete for the consumer pool (Hughes, 1996).

Many manufacturers, including some manufacturers of orthodontic products, now utilize direct to consumer marketing techniques to increase sales. Direct marketing refers to marketing efforts by the manufacturer aimed directly at the end-user (www.entrepreneur.com, 2004). Manufacturers such as Align Technologies (Invisalign[®]), Ormco (Damon[®]), DenMat Holdings (Six Month Smiles[®] and Snap-On Smile[®]) are utilizing web sites, pay per click, and banner advertisements to market directly to the public.

Claims Made By Manufacturers

Companies utilizing direct marketing have made various claims regarding the nature of their products. As of November 21, 2011, the following is a list of claims stated on various orthodontic manufacturer's websites:

Align Technologies (Invisalign[®]):

- “Invisalign[®] is the modern way to straighten teeth”

- “Invisalign® doesn’t irritate gums like traditional metal wires and brackets”
- “Invisalign® aligners can be easily removed for brushing, flossing and eating which means no food stuck in your braces and no avoiding hard-to-eat foods”
- “It’s easier to floss and brush during treatment with Invisalign® because it’s removable, unlike traditional metal wires and brackets”
- “Invisalign® costs about as much as traditional metal braces and is often covered by orthodontic insurance plans”
- “Over 1 million adults and teens have chosen Invisalign® to create the smile they want”

Ormco (Damon®):

- “Traditional treatment often requires removal of healthy teeth and/or the use of palatal expanders to make space. This approach is often uncomfortable, takes longer, and can leave a narrower arch and a flat profile.”
- “Damon® smiles are full, natural 10-tooth smiles achieved with light biologically-sensible forces, and are specifically designed to improve the overall facial result of each patient.”
- “Traditional braces are tied in with elastics, which cause friction and pressure, making treatment slower and less comfortable. Damon® braces use a slide mechanism to hold the wire, which allows teeth to move more freely, quickly and comfortably”

- “With the Damon[®] System, treatment time is typically shorter than with conventional braces. And shorter treatment time means fewer appointments and a beautiful smile...faster. You may be surprised at how fast.”
- “The days of having braces tightened are over. This revolutionary new approach to orthodontics ensures greater comfort throughout treatment. That's because Damon[®] System braces have a unique slide mechanism that allows your doctor to use far lighter forces to move teeth to their correct positions. So not only is your treatment shorter, it is also far more comfortable. Many people experience little to no discomfort in treatment”
- “Less teeth need to be pulled. With conventional braces, orthodontists are often forced to pull teeth in order to create space for crowded teeth. No one likes to have teeth removed, and a smile with a full display of teeth often produces a broader, natural smile and a nicer profile. The Damon[®] System uses biologically sensible forces which work with the body's natural adaptive processes to create space naturally, so doctors using the Damon[®] System can now treat most cases without extraction.”
- “In the few cases which still require extraction, space is made to improve facial balance and symmetry to provide a natural smile and profile that will last as you age.”
- “In the past, creating space and developing arches required bulky headgear and palatal expanders. The Damon[®] System's revolutionary approach uses light, biologically-sensible forces to develop beautiful natural arches, in

most cases without the need for headgear or palatal expanders. It's far easier and more comfortable to get the beautiful smile you've always dreamed of.”

DenMat Holdings (Six Month Smiles®):

- “Effective, safe and affordable cosmetic solution that fits your lifestyle”
- “Average treatment time of only six months”
- “Lucid-Lok clear brackets and tooth-colored wires are barely visible”
- “Six Month Smiles® Patient Tray Kits ensure that your appointments are fast and comfortable”
- “Low forces and short overall treatment times increase comfort, safety, and hygiene”
- “Six Month Smiles® is typically less expensive than traditional braces, aligner therapy, or veneers”

DenMat Holdings (Snap-On Smile®):

- “Snap-On Smile® is an affordable, non-invasive, and completely reversible, cosmetic, removable arch that can easily and painlessly give you a beautiful smile”
- Snap-On Smile® “...is an excellent choice for: gap, crooked, stained or missing teeth; those who are not candidates for bridges or implants; anyone who would like a Hollywood smile without the expense and discomfort of complex and invasive dental procedures”

Changes in the Way Patients Receive Information

The shift in the way that Americans receive information is not only seen in the way that manufacturers provide information to consumers, but also but in the way that consumers become informed about products and how consumers communicate with each other. Sixty-seven percent of cell phone users in the United States also use their cell phones to text message; with over half also utilizing social media sites such as MySpace, LLC (launched in August 2003), Facebook, Inc. (launched in February 2004), YouTube, LLC (launched in November 2005), Twitter Inc. (launched in July 2006), and Pinterest (launched in March 2010). The way in which we communicate is also changing (Pew Research Center, 2011). Knösel and Jung conducted a study to assess the informational value, source, bias, and intention of videos posted on YouTube, LLC (Knösel and Jung, 2011). They found that the majority of orthodontic-related videos posted to the site were posted by patients, with a poor and inadequate representation of the profession and low informational content (Knösel and Jung, 2011). Users once were consumers of web-available resources; now, users generate the information on the internet through social media sites (Randeree, 2009).

With over two million people worldwide using the internet (Internet World Stats, 2011), this medium is a firmly established method of information retrieval and communication. Health-related websites are easily accessible to anyone with internet access (Diaz, 2002). However, any person or company with access to the internet can contribute information for others to read, and this information is not peer reviewed. Because of this, the internet can be a source of inaccurate, biased, and highly variable information (Silberg, 1997; Gagliardi, 2002). In many cases, the quality of information

related to health care is problematic (Eysenbach, 2002). As patients and their parents are informed of the potential orthodontic treatment options, they may seek further information about these options. Their source of this information may come from the internet, which may give them a biased or inaccurate sense of knowledge. One study showed that information available through the internet regarding orthodontic extractions is variable, and that top-rated sites are not necessarily those of the best quality (Patel and Cobourne, 2011).

Additionally, advertisements by many manufacturers are appearing on social media sites to increase awareness of their products. With social networking sites such as Facebook, Pinterest, and Google+ stepping in as a primary communication channel for some people, these direct marketing efforts can be significant (Belicove ME, 2012). Social media has become a common form of communication and information sharing, especially in the younger population; a study by the Pew Research Center showed that 80% of Americans age 18-29, and 62% of Americans age 30-49 use social networking, while only 26% of Americans aged 50 or older use social networking (Pew Research Center, 2011). Another survey showed that, while 13-20 year-olds make up about 13.6 percent of the population, they constitute 22 percent of Facebook users (Cohn, 2012).

Over half of Americans aged 18-34 have smartphones, and seventy percent of those with smartphones use their devices for price comparisons and to find retail locations (Newman, 2011). A study by the Pew Research Center found that seventy-three percent of 18-29 year-olds use their cell phone for the internet, while only forty-nine percent of those aged 30-49 utilized internet on their cell phones (Pew Research Center,

2011). With information this accessible, consumers are demanding information and options and taking the initiative to learn about their healthcare choices.

The US Department of Education stated that in 2008, an estimated 100 percent of public schools had one or more instructional computers with internet access, and the ratio of students to these devices was 3.1:1 (US Department of Education, National Center for Education Statistics, 2010). Internet access at school is limited by security features built into the system by The Children's Internet Protection Act (CIPA) (Federal Communications Commission, 2001). CIPA addresses concerns about internet safety for minors and restricts websites, chats, and online mail that may be inappropriate or harmful to children. Internet usage at home, however, may be less restrictive, as restrictions must be specifically programmed by the user.

There are differences in the way in which females and males are influenced by advertisements. Females process advertisements more elaborately and subjectively than males (Wolin, 2003). Women are more influenced by multiple exposures to an advertisement and more accepting of advertisements directed at males than males are accepting of female advertisements (Wolin, 2003).

The purpose of this research was to determine the influence of various demographic and social factors on patient perceptions of orthodontic products. Patients' knowledge of manufacturer's claims of each of the aforementioned treatment types, as well as the desirability of each treatment type was explored. This information may assist orthodontists and dental professionals in answering questions that patients may have about their orthodontic care. If orthodontists are aware of misleading claims made by

manufacturers, they can better inform their patients about orthodontics and the benefits of ethical orthodontic care. It will also help patients in that their opinions about orthodontic treatment methods will be better known by dental providers.

PURPOSE OF THE STUDY

The objective of this study was to determine patient knowledge of, and attitude toward, claims made by various orthodontic manufacturers.

HYPOTHESES

How much knowledge do patients have of manufacturer's claims, and how desirable do patients view each treatment type? The demographic variables to be considered and hypotheses associated with these variables are listed below:

Gender

- Null hypotheses:
 - Females and males are equally knowledgeable of various manufacturers' claims.
 - There is no significant difference between males' and females' views of Invisalign®.
- Research hypotheses:
 - Females more than males have more knowledge of various manufacturers' claims.
 - Females more than males think that Invisalign® is more desirable.

Age

- Null hypotheses:
 - Individuals in age groups (14-18, 19-30, and 31-50 year olds) are equally knowledgeable of various manufacturers' claims.
 - Individuals in age groups (14-18, 19-30, and 31-50 year olds) think that Invisalign® is equally desirable.
- Research Hypotheses:
 - 19-30 year olds are more knowledgeable of various manufacturers' claims than 14-18 year olds and 31-50 year olds.

- 19-30 year olds think that Invisalign® is more desirable than do 14-18 year olds and 31-50 year olds.

Ethnicity

- Null hypotheses:
 - All ethnic groups studied are equally knowledgeable about various manufacturers' claims.
 - All ethnic groups studied think that Invisalign® is equally desirable.
- Research Hypotheses:
 - Studied ethnic groups demonstrate a significant difference in their knowledge of various manufacturers' claims.
 - Studied ethnic groups demonstrate a significant difference in how desirable they view Invisalign®.

Differences in Population Between Patients in Private Practice and the Dental School

- Null hypotheses:
 - There is no difference in the knowledge of manufacturer's claims between patients receiving care at the Dental School or care in private practices.
 - There is no significant difference in the desirability of Invisalign® between patients receiving care at the Dental School or care in private practices.
- Research Hypotheses:
 - Patient knowledge of various manufacturer's claims varies by place of treatment.
 - Patient perception of the desirability of Invisalign® varies by place of treatment.

MATERIALS AND METHODS

In order to examine differences between patient groups, a survey instrument was developed. This instrument asked questions to determine the demographic and social parameters of each patient, their knowledge of manufacturers' claims, and their acceptance of various manufacturers' claims.

IRB Exemption

This project was submitted to the Internal Review Board at UMD to be evaluated, and the project determined Exempt (protocol HP-00052449). The exemption date was April 26, 2012.

Survey Development and Design

Pilot studies

Before the survey instrument was finalized, two pilot studies were done. The first study tested the clarity of the proposed questions, while the second study incorporated and tested recommendations from the thesis committee on the content of the survey instrument. The final survey instrument (Appendix A: Survey Instrument) was the result of committee agreement and these two pilot studies. Each patient was given the survey by one of the front desk staff upon entering the practice, and asked to complete the survey prior to seeing the orthodontist for an initial consultation.

Pilot #1:

Methods: A pilot study of fifteen surveys was distributed to patients presenting for initial screening appointments at the Dental School to (1) determine whether the

questions were fashioned in a way that respondents could understand and (2) verify that there would be a sufficient number of people who were not excluded due to the following exclusion criteria:

- The patient had been examined by another orthodontist, or
- They had brothers, sisters, children, or parents that had previously received orthodontic treatment.

It was thought that these groups should be excluded because patients with previous orthodontic experience may be more informed about treatment methods than patients presenting for the first time. In addition, it was thought that patients with relatives with previous orthodontic experience would be more informed about treatment methods than patients who did not.

Results: Of the fifteen survey instruments distributed to patients, thirteen were completed. Two surveys were not completed since they were inadvertently administered to patients that were under the age of fourteen. Of the remaining thirteen surveys, one respondent did not answer the demographic information, gender and age. Of the remaining twelve respondents, ten were eliminated because of the exclusion criteria (previous appointment with another orthodontist; or brothers, sisters, children, or parents that had orthodontics previously). Even though only two of the respondents were eligible to complete the survey, seven participants completed the survey instrument. These responses were used to modify the survey items to make the instrument more straightforward and to include more patients.

Pilot #2:

Methods: A second pilot study was administered based on revisions of the first instrument and recommendations from the thesis committee. This pilot included a Likert scale for patients to indicate how much they knew about each treatment type (“conventional braces”, Invisalign[®], Damon[®], Six Month Smiles[®], and Snap-On Smile[®]), as well as questions to determine where the patient had heard about each treatment type. While these additional questions were considered important, patients still needed to be able to complete the survey instrument within a reasonable amount of time (five to seven minutes).

Results: Of the nine surveys administered, seven were completed. Two were not completed because they were called for their appointments before completing the surveys. Of the seven completed surveys, all respondents demonstrated an acceptable level of understanding of the questions. The average time that a respondent took to complete the instrument was 9.8 minutes, with a range of six to fifteen minutes. In order to reduce the time needed for a patient to complete each survey, the question that asked patients where they had heard about each type of treatment was removed.

Final study methodology

The survey instrument was finalized (see Appendix A: Survey Instrument) and distributed to two groups of patients: those presenting at the Dental School, and those presenting to private orthodontic practices in the Baltimore/Washington, D.C. area. Distributing the instrument in the same geographic area helped ensure that each patient was exposed to similar regional advertisements in terms of television channels; and social and personality characteristics may be similar within specific geographic areas.

Instruments were distributed in the private practices of eight part-time orthodontic faculty at the Dental School.

Power Analysis

It was decided that small to medium differences in treatment desirability and agreement with claims would be sufficient to accept a difference in responses between genders and between ages. The results of the power analysis indicated that 300 subjects were needed, 150 subjects of each gender, and 100 subjects in each of the three age groups (14-18, 19-30, 31-50).

Gender: with 2 levels, 150 cases per level, and an effect size of 0.16, a 2-tailed test, and a p of 0.05, power was equal to 0.79.

Age: with 3 levels, 100 cases per level, and an effect size of 0.18, a 2-tailed test, and a p of 0.05, power was equal to 0.80.

Sample Size

Based on gender and age, different groups of patients were constructed. These groups were: males age 14-18; females age 14-18; males age 19-30; females age 19-30; males age 31-50; and females age 31-50. It was decided that having fifty respondents in each of the above listed groups was a reasonable sample size for this project. With this sample size, 300 patients could be surveyed, 150 males and 150 females with 100 total in each of the three age groups (ages 14-18, ages 19-30, and ages 31-50). It was decided that the study would run for four months, and would be terminated at that time even if the target number was not reached. During the four months of the trial, 131 instruments were obtained.

Demographic Variables

Data relating to the participants' demographic characteristics: gender, age group (either age 14-19, 19-30, or 31-50), and ethnicity (Caucasian, African American, Hispanic, Asian, and "Other") was collected.

The three different age groups, ages 14-18, 19-30, and 31-50, were chosen to correspond with ages that may differ in their method of obtaining information about orthodontic treatment. Responders ages 14-18 were school age. While peer pressure may have a strong influence on the desired treatment method, the ultimate selection would be primarily determined by the parents. Young adults in the 19-30 age group may be more independent about their choices. They may be just starting their professional careers, becoming more independent, or searching for a spouse. Adults in the 31-50 age group did not grow up with daily computer use. This age group is more likely to be married and influenced by a spouse, rather than peers. These responders may have children and may have been considering orthodontics for their children as well.

Variables in social and media influences

The following social variables were determined:

- Had the patient's family dentist talked to the patient about needing braces?
- Did the patient have a previous appointment with a different orthodontist to talk about braces? If so, patients were asked why they sought a second opinion.

- Did the patient have any close relatives (parents, sisters, brothers, or children) who have received orthodontic care?
- What level of schooling had the patient completed?

Media exposure to the internet, television, and magazines may also be important influences on patient decisions. The following media exposure was determined:

- Did the patient use a computer with internet access at home?
- Did the patient use a computer with internet access at work or school?
- Did the patient have a phone with internet access?
- Did the patient have a television with cable or satellite at home?
- Did the patient read magazines regularly?

If the patient had access to the internet, they were asked to indicate how many hours a week they spent surfing the internet for leisure. If they had access to either television with cable or satellite, they were asked how many hours a week they spent watching television.

The amount of internet access was assessed by three questions since the exposure to advertisements may differ based on where the internet was accessed. Some workplaces may restrict pop-up advertisements and the use of certain webpages (such as social media sites) on their computers. In schools, there are time limits on internet use; not every student may have a personal computer, and computer use may be restricted to certain times such as library hours or free time. Internet usage at home may be less restrictive, as the individual can remain on the internet for as long as he or she desires, and unless blocked by an anti-virus program and parental controls, there are no blocked websites.

Patients were asked to list the magazines he or she read regularly to determine the amount of magazine exposure. Magazines are also published at different time intervals. While some magazines may publish their material weekly or monthly, others may publish only quarterly. The term “regularly” was included to determine the magazines that were routinely read, rather than read sporadically.

Level of familiarity with treatment types

Each patient was asked their level of familiarity with each of the following treatment types: conventional braces, Invisalign[®], Damon[®], Six Month Smiles[®], and Snap-On Smile[®]. A patient’s level of familiarity was assessed with a Likert Scale.

Assessment of knowledge of manufacturer’s claims and desirability of Invisalign[®]

Knowledge of manufacturer’s claims

Questions regarding treatment methods were fashioned based on claims made on manufacturer’s websites and in magazine or television ads. If two treatment modalities claimed similar advantages, the question was only listed once. Some questions were phrased in a positive manner, while other questions were phrased in a negative manner to ensure that the patients read the question instead of responding automatically. Table 1 is a list of statements compiled from manufacturer’s claims. Column 1 states the claim used in the survey instrument, and column 2 states the name of the manufacturer making the claim and how a respondent would answer if he or she had knowledge of the claim. With each comparative statement, the patient was asked if the statement was True, False, or Don’t Know, when comparing the treatment to traditional “braces”. It should be noted

some statements may relate to a specific treatment type, but may not be claimed as an advantage in the manufacturer's advertising.

Table 1. Statements compiled from manufacturer's claims

Claim used in survey instrument	Manufacturer making the claim and how a respondent would answer if the respondent were to answer based on the claim made
It is easier to brush with this treatment	Invisalign®. Responses consistent with this claim will answer "True"; it is easier to brush with Invisalign®.
It harder to floss with this treatment	Invisalign®. Responses consistent with this claim will answer "False"; that it is not harder to floss with Invisalign®.
This treatment is less comfortable	Six Month Smiles®. Responses consistent with this claim will answer "False"; Six Month Smiles® claims that their Patient Tray Kits ensure that the patient's appointments are fast and comfortable.
	Damon® braces. Responses consistent with this claim will answer "False"; Damon® claims that Damon® orthodontics ensures greater comfort throughout treatment.
This treatment costs less	Six Month Smiles®. Responses consistent with this claim will answer "True"; Six Month Smiles® claims that their treatment is typically less expensive than traditional braces, aligner therapy, or veneers.
	Snap-On Smile®. Responses consistent with this claim will answer "True"; Snap-On Smile® claims that their system is affordable.
	Invisalign®. Responses consistent with this claim will answer "False"; that Invisalign® does not cost less. Invisalign® claims that their treatment costs about as much as traditional braces.
This treatment is more painful	Snap-On Smile®. Responses consistent with this claim will answer "False"; Snap-On Smile® claims that their system can painlessly give the patient a beautiful smile.
	Damon® braces. Responses consistent with this claim will answer "False"; Damon® claims that Damon® orthodontics ensures greater comfort throughout treatment.
This treatment is more likely to require extractions (tooth removal)	Damon® braces. Responses consistent with this claim will answer "False"; with Damon® braces, less teeth need to be extracted.
This treatment is more likely to give you the smile that you want	Damon® braces. Responses consistent with this claim will answer "True"; Damon® claims that with Damon® braces, it's far easier and more comfortable to get the beautiful smile you've always dreamed of.
This treatment is more likely to use a headgear	Damon® braces. Responses consistent with this claim will answer "False"; Damon® claims that they use biologically-sensible forces to develop the arch instead of headgear and palatal expanders.
This treatment requires more office visits	Damon® braces. Responses consistent with this claim will answer "False"; Damon® claims to complete orthodontic cases faster and with fewer appointments.

Table 1 continued

This treatment is more likely to give you a broader smile	Damon [®] braces. Responses consistent with this claim will answer "True"; Damon [®] claims that they can create a broader, more natural smile.
This treatment is faster	Six Month Smiles [®] . Responses consistent with this claim will answer "True"; Six Month Smiles [®] claims that average treatment time with their appliance is six months.
	Damon [®] braces. Responses consistent with this claim will answer "True"; Damon [®] claims to complete orthodontic cases faster and with fewer appointments.
This treatment uses heavier forces to move teeth	Six Month Smiles [®] . Responses consistent with this claim will answer "False"; Six Month Smiles [®] claims that their system uses low forces to increase comfort and safety.
	Damon [®] braces. Responses consistent with this claim will answer "False"; Damon [®] claims that their system moves teeth with light biologically-sensible forces.
This treatment is more visible	Six Month Smiles [®] . Responses consistent with this claim will answer "False"; Six Month Smiles [®] claims their brackets and wires are barely visible.
	Invisalign [®] . Responses consistent with this claim will answer "False"; Invisalign [®] claims that they can move teeth without metal brackets and wires.

Desirability of Treatment Types

By evaluating the number of times a patient responded true to a positive statement or false to a negative statement, the desirability of different treatment types was determined for each respondent. Table 2 summarizes positive responses to manufacturer's claims. The first column of Table 2 is a list of statements made in the survey instrument compiled from manufacturer's claims; the second column shows the way in which a patient would respond favorably to the claim. Patients responding in a favorable manner to these claims may believe that the treatment type is more desirable than treatment with conventional braces.

Table 2. Statements contained in survey instrument based on manufacturer's claims, and the patient response that would indicate if he or she responded favorably towards the claim

Claim used in Survey	Positive response to Claim
It is easier to brush with this treatment	TRUE
It harder to floss with this treatment	FALSE
This treatment is less comfortable	FALSE
This treatment costs less	TRUE
This treatment is more painful	FALSE
This treatment is more likely to require extractions (tooth removal)	FALSE
This treatment is more likely to give you the smile that you want	TRUE
This treatment is more likely to use a headgear	FALSE
This treatment requires more office visits	FALSE
This treatment is less likely to utilize jaw expansion	TRUE
This treatment is more likely to give you a broader smile	TRUE
This treatment is faster	TRUE
This treatment uses heavier forces to move teeth	FALSE
This treatment is more visible	FALSE

Data Collection and Statistical Analysis

Data entry

Data was entered into Microsoft Excel by one researcher and verified by a second researcher for data entry accuracy.

Statistical tests

A chi-square test was used to measure all questions using categorical data (from the Dental School Toolbox statistical program). The dependent variables in the chi-square test were: gender, age, ethnicity, and place of care. For the data that did not meet the assumptions of the chi-square test, the Fisher's exact test was used (<http://graphpad.com/quickcalcs/contingency1/>, Accessed 23 March 2013). Analysis of

Variance (ANOVA) was used (SPSS for Windows, version 20, SPSS Inc, Chicago, Ill) to compare (a) knowledge of manufacturer's claims, (b) knowledge of Invisalign[®]'s claims specifically, and (c) desirability of Invisalign[®] between the dependent variables (gender, age, ethnicity, and place of care).

RESULTS

Number of survey instruments collected

A total of 163 patients were surveyed, 63 at the Dental School and 69 in private practices. One survey from a private practice office was not completed with enough answers to allow analysis of the results, so this patient's responses were not included in the analysis. A breakdown of the number of the responses based on gender and age group can be found in Table 3. The 300 patient surveys that were needed for statistical significance were not collected. This may be due to limited pre-treatment waiting time, patients outside of the age range targeted for this study seeking treatment, or patient refusal to be included in the study. The effect of this lack of power is indicated in the results and discussion.

Summary of demographic variables, knowledge of manufacturer's claims, and desirability of treatment types

Table 3 summarizes the demographics of patients seeking orthodontic care in both the Dental School and private practice settings. Table 4 illustrates the number and percent of respondents seeking orthodontic care at the Dental School that responded with knowledge of manufacturer's claims. Table 5 illustrates the number and percent of respondents seeking orthodontic care at the Dental School that responded in a favorable manner towards manufacturer's claims. Table 6 illustrates the number and percent of respondents seeking orthodontic care at private practices in the Baltimore/Washington D.C. area that responded in a favorable manner towards manufacturer's claims. For the survey instrument, the statements were presented mixed as both positive and negative; for

analysis, all results were reported with positive statements. Therefore, in the results and discussion section, all statements have been phrased positively.

Table 3. Demographic responses of patients completing the survey at the University of Maryland Dental School and in private orthodontic offices in the Baltimore/Washington, D.C. area

	Respondents (%) seeking care at the dental school	Respondents (%) seeking care in private practice	Total Respondents (%)
Gender*			
Male	24 (38.1%)	26 (37.7%)	50 (37.9%)
Female	39 (61.9%)	43 (62.3%)	82 (62.1%)
Age*			
14-18	28 (44.4%)	29 (42.0%)	57 (43.2%)
19-30	14 (22.2%)	20 (29.0%)	34 (25.8%)
31-50	21 (33.3%)	20 (29.0%)	41 (31.1%)
Orthodontic treatment recommended by family dentist			
Yes	46 (73.0%)	46 (67.6%)	92 (70.1%)
No	16 (25.4%)	22 (32.4%)	38 (29.2%)
Previous visit to a different orthodontist			
Yes	29 (46.0%)	25 (37.9%)	54 (42.2%)
No	33 (52.4%)	41 (62.1%)	74 (57.9%)
Reason for visit to a second orthodontist*			
Expense	17 (58.6%)	5 (15.6%)	22 (27.5%)
Treatment plan	5 (17.2%)	6 (18.8%)	11 (13.8%)
Distance to other office	5 (13.8%)	4 (12.5%)	9 (11.3%)
Relapse	10 (34.5%)	8 (25.0%)	18 (22.5%)
Other	11 (37.9%)	9 (28.1%)	20 (25.0%)
Family members with previous orthodontics			
Yes	32 (51.6%)	33 (50.8%)	65 (51.2%)
no	30 (48.4%)	32 (49.2%)	62 (48.9%)
Ethnicity*			
Caucasian	16 (26.7%)	31 (44.9%)	47 (36.4%)
African American	30 (50%)	15 (21.7%)	45 (34.9%)
Hispanic	4 (6.7%)	9 (13.0%)	13 (10.1%)
Asian	7 (11.7%)	9 (13.0%)	16 (12.4%)

Table 3 continued

Have not completed high school	16 (25.8%)	14 (21.2%)	30 (23.4%)
High school graduate	10 (16.1%)	9 (13.6%)	19 (14.9%)
Have completed some college	11 (17.7%)	8 (12.1%)	19 (14.9%)
Have completed a Bachelor's Degree	7 (11.3%)	14 (21.2%)	21 (16.4%)
Have completed some postgraduate education or a postgraduate degree	12 (19.4%)	14 (21.2%)	26 (20.3%)
Computer with internet access at home			
Yes	56 (94.9%)	64 (95.5%)	120 (95.2%)
No	3 (5.1%)	3 (4.5%)	6 (4.8%)
Computer with internet access at work or school			
Yes	51 (89.5%)	57 (86.4%)	108 (87.8%)
No	6 (10.5%)	9 (13.6%)	15 (12.2%)
Phone with internet access			
Yes	48 (78.7%)	51 (76.1%)	99 (81.8%)
No	13 (21.3%)	9 (13.6%)	22 (18.2%)
Hours a week spent surfing the internet for leisure			
0	1 (1.6%)	0 (0%)	1 (0.8%)
Less than 1	3 (4.9%)	10 (15.2%)	13 (10.2%)
1-2	18 (29.5%)	20 (30.3%)	38 (29.9%)
3-5	11 (18.0%)	13 (19.7%)	24 (18.9%)
6 or more	28 (45.9%)	23 (34.8%)	51 (40.2%)
Television with cable/satellite at home			
Yes	51 (92.7%)	50 (89.3%)	101 (9.2%)
No	4 (7.3%)	6 (10.7%)	10 (9.0%)
Hours a week spent watching television			
0	1 (1.7%)	2 (3.1%)	3 (2.4%)
Less than 6	34 (58.6%)	38 (58.5%)	72 (58.5%)
7-11	14 (24.1%)	16 (24.6%)	30 (24.4%)
12 or more	9 (15.5%)	9 (13.8%)	18 (14.6%)
Number of magazines read regularly*			
0	19 (50.0%)	12 (26.7%)	31 (37.3%)
1	9 (23.7%)	9 (20.0%)	18 (21.7%)
2	7 (18.4%)	11 (24.4%)	18 (21.7%)
3	3 (7.9%)	8 (17.7%)	11 (13.3%)
4	0 (0%)	5 (11.1%)	5 (6.0%)

Table 3 continued

Patient's Chief Complaint*			
Crowding	21 (33.3%)	33 (47.8%)	54 (20.7%)
Spacing	25 (39.7%)	16 (23.2%)	41 (15.7%)
Crooked teeth	24 (38.1%)	26 (37.7%)	50 (19.2%)
Underbite	4 (6.3%)	6 (8.7%)	10 (3.8%)
Overbite	29 (46.0%)	15 (21.7%)	44 (16.9%)
Dentist recommendation	28 (44.4%)	19 (27.5%)	47 (18.0%)
Other	9 (14.3%)	6 (8.6%)	15 (5.7%)
Patient's perceived knowledge of Braces			
1, no knowledge	5 (8.2%)	6 (9.7%)	11 (9.0%)
2	20 (32.8%)	14 (22.6%)	34 (27.9%)
3	16 (26.2%)	21 (33.9%)	37 (30.3%)
4	13 (21.3%)	15 (24.2%)	28 (23.0%)
5, very much knowledge	6 (9.8%)	6 (9.7%)	12 (9.8%)
Patient's perceived knowledge of Invisalign®			
1, no knowledge	26 (42.6%)	21 (33.9%)	47 (38.2%)
2	16 (26.2%)	23 (37.1%)	39 (31.7%)
3	12 (19.7%)	14 (22.6%)	26 (21.1%)
4	7 (11.5%)	3 (4.8%)	10 (8.1%)
5, very much knowledge	0 (0%)	1 (1.6%)	1 (0.8%)
Patient's perceived knowledge of Damon® Braces			
1, no knowledge	50 (82%)	57 (91.9%)	107 (87.0%)
2	4 (6.6%)	3 (4.8%)	7 (5.7%)
3	5 (8.2%)	1 (1.6%)	6 (4.9%)
4	1 (1.6%)	1 (1.6%)	2 (1.6%)
5, very much knowledge	1 (1.6%)	0 (0%)	1 (0.8%)
Patient's perceived knowledge of Six Month Smiles®			
1, no knowledge	55 (90.2%)	61 (98.4%)	116 (94.3%)
2	2 (3.3%)	1 (1.6%)	3 (2.4%)
3	3 (4.9%)	0 (0%)	3 (2.4%)
4	1 (1.6%)	0 (0%)	1 (0.8%)
5, very much knowledge	0 (0%)	0 (0%)	0 (0%)
Patient's perceived knowledge of Snap-On Smile®			
1, no knowledge	53 (86.9%)	58 (93.5%)	111 (90.2%)
2	2 (3.3%)	3 (4.8%)	5 (4.1%)
3	5 (8.2%)	1 (1.6%)	6 (4.9%)
4	1 (1.6%)	0 (0%)	1 (0.8%)
5, very much knowledge	0 (0%)	0 (0%)	0 (0%)
Response rate*			
Patient's completing some aspect of questions on manufacturer's claims	57 (90.5%)	53 (76.8%)	110 (83.3%)

* These responses were analyzed statistically. Please see Tables 7-16.

Table 4. Knowledge of manufacturer's claims in respondents seeking care at the University of Maryland Dental School and in private practice

	Number (%) of respondents at the Dental School that answered the statement in accordance with a claim	Number (%) of respondents in private practice that answered the statement in accordance with a claim	Number (%) of respondents that answered the statement in accordance with a claim
Claims Made by Manufacturers			
Claims made by Invisalign®			
It is easier to brush with this treatment	18 (75.0%)	31 (100%)	49 (89.1%)
It is easier to floss with this treatment	20 (76.9%)	23 (76.7%)	43 (76.8%)
This treatment costs less	18 (85.7%)	21 (87.5%)	39 (86.7%)
This treatment is less visible	26 (96.3%)	28 (96.6%)	54 (96.4%)
Overall agreement with claims	83.50%	90.2%	87.20%
Claims made by Damon®			
This treatment is more comfortable	4 (36.4%)	3 (50.0%)	7 (41.1%)
This treatment is less painful	3 (27.3%)	2 (50.0%)	5 (33.3%)
This treatment is less likely to require extractions (tooth removal)	1 (12.5%)	2 (40.0%)	3 (23.1%)
This treatment is more likely to give you the smile that you want	11 (91.7%)	3 (75.0%)	14 (87.5%)
This treatment is less likely to use a headgear	1 (16.7%)	2 (66.7%)	3 (33.3%)
This treatment requires fewer office visits	2 (18.2%)	1 (33.3%)	3 (21.4%)
This treatment is less likely to utilize jaw expansion	2 (50%)	3 (75.0%)	5 (62.5%)
This treatment is more likely to give you a broader smile	6 (66.7%)	4 (100%)	10 (76.9%)
This treatment is faster	2 (28.6%)	4 (100%)	6 (54.5%)
This treatment uses lighter forces to move teeth	0 (0%)	0 (0%)	0 (0%)
Overall agreement with claims	34.80%	59.0%	43.4%
Claims made by Six Month Smiles®			
This treatment is more comfortable	4 (57.1%)	0 (0%)	4 (57.1%)
This treatment costs less	2 (50.0%)	1 (33.3%)	3 (42.9%)
This treatment is faster	7 (87.5%)	2 (66.7%)	9 (81.8%)
This treatment uses lighter forces to move teeth	0 (0%)	0 (0%)	0 (0%)
This treatment is less visible	3 (42.9%)	0 (0%)	3 (42.9%)
Overall agreement with claims	47.50%	20.0%	44.9%

Table 4 continued

Claims made by Snap-On Smile®			
This treatment costs less	3 (50%)	1 (50.0%)	4 (50.0%)
This treatment is less painful	7 (100%)	0 (0%)	7 (100%)
Overall agreement with claims	75%	25.0%	75.0%

Table 5. Number and percent of respondents seeking orthodontic care at the University of Maryland Dental School that answered favorably towards manufacturers' claims

Statement	Invisalign® Number (%) of respondants that answered positively about Invisalign® to this statement	Damon® Braces Number (%) of respondants that answered positively about Damon® braces to this statement	Six Month Smiles® Number of (%) respondants that answered positively about Six Month Smiles to this statement	Snap-On Smiles® Number (%) of respondants that answered positively about Snap-On Smiles® to this statement
It is easier to brush with this treatment	18 (75.0%)	5 (62.5%)	3 (60.0%)	7 (100%)
It is easier to floss with this treatment	20 (76.9%)	3 (27.3%)	5 (71.4%)	6 (75.0%)
This treatment is more comfortable	19 (86.4%)	4 (36.4%)	4 (57.1%)	8 (88.9%)
This treatment costs less	3 (14.3%)	6 (75.0%)	2 (50.0%)	3 (50.0%)
This treatment is less painful	18 (100%)	3 (27.3%)	4 (57.1%)	7 (100.0%)
This treatment is less likely to require extractions (tooth removal)	12 (80.0%)	1 (12.5%)	2 (33.3%)	5 (62.5%)
This treatment is more likely to give you the smile that you want	15 (83.3%)	11 (91.7%)	6 (75.0%)	7 (70.0%)
This treatment is less likely to use a headgear	15 (100.0%)	1 (16.7%)	2 (40.0%)	6 (85.7%)
This treatment requires fewer office visits	8 (53.3%)	2 (18.2%)	4 (66.7%)	6 (75.0%)
This treatment is less likely to utilize jaw expansion	4 (40%)	2 (50%)	2 (40.0%)	5 (71.4%)
This treatment is more likely to give you a broader smile	5 (45.5%)	6 (66.7%)	3 (50.0%)	4 (57.1%)
This treatment is faster	8 (40.0%)	2 (28.6%)	7 (87.5%)	9 (90.0%)
This treatment uses lighter forces to move teeth	12 (75.0%)	0 (0%)	0 (0%)	5 (71.4%)
This treatment is less visible	26 (96.3%)	0 (0%)	3 (42.9%)	5 (55.6%)
Total number of positive responses (%) to treatment type (of 14 statements)	183 (69.0%)	46 (36.6%)	47 (52.2%)	83 (75.2%)

Table 6. Number and percent of respondents seeking orthodontic care in private practices that answered favorably to manufacturers' claims

	Invisalign®	Damon® Braces	Six Month Smiles®	Snap-On Smile®
Statement	Number (%) of respondents that answered positively about Invisalign® to this statement	Number (%) of respondents that answered positively about Damon® braces to this statement	Number (%) of respondents that answered positively about Six Month Smiles® to this statement	Number (%) of respondents that answered positively about Snap-On Smile® to this statement
It is easier to brush with this treatment	31 (100%)	2 (33.3%)	0 (0%)*	1 (33.3%)
It is easier to floss with this treatment	23 (76.7%)	2 (33.3%)	0 (0%)*	1 (50.0%)
This treatment is more comfortable	18 (75.0%)	3 (50.0%)	0 (0%)	1 (100%)
This treatment costs less	3 (12.5%)	4 (80.0%)	1 (33.3%)	1 (50.0%)
This treatment is less painful	21 (91.3%)	2 (50.0%)	1 (100%)	0 (0%)*
This treatment is less likely to require extractions (tooth removal)	14 (87.5%)	2 (40.0%)	0 (0%)*	0 (0%)*
This treatment is more likely to give you the smile that you want	10 (62.5%)	3 (75.0%)	0 (0%)*	0 (0%)*
This treatment is less likely to use a headgear	15 (83.3%)	2 (66.7%)	0 (0%)*	1 (100%)
This treatment requires fewer office visits	14 (73.7%)	1 (33.3%)	1 (50.0%)	1 (100%)
This treatment is less likely to utilize jaw expansion	7 (50.0%)	3 (75.0%)	1 (100%)	0 (n/a)*
This treatment is more likely to give you a broader smile	8 (66.7%)	3 (75.0%)	0 (n/a)*	0 (0%)*
This treatment is faster	12 (54.5%)	4 (100%)	2 (66.7%)	0 (0%)*
This treatment uses lighter forces to move teeth	16 (88.9%)	0 (0%)*	0 (0%)*	0 (NA)*
This treatment is less visible	28 (96.6%)	1 (25.0%)	0 (0%)*	0 (NA)*
Total number of positive responses (%) to treatment type (of 14 statements)	220 (72.8%)	32 (54.4%)	6 (26.9%)	6 (39.4%)

* When there were respondents who answered the statement, but no one responded in accordance with manufacturer's claims, percent of respondents answering in accordance with manufacturer's claims is noted as 0%. When there were no respondents who answered the statement either in accordance or against the claim, the percent of respondents answering in accordance with manufacturer's claims is noted as NA.

Due to the amount of data gathered, data will be discussed by major concept, instead of by table number. Demographic data for patients at the Dental School versus private practice will be compared to determine if these two populations are similar enough to combine the data when analyzing knowledge of manufacturer's claims in general, knowledge of Invisalign[®] claims specifically, and the desirability of Invisalign[®].

Differences in Demographic Variables between Dental School and Private Practice Patients

There was no significant difference in gender (Table 7, chi-square = 0.002; $p > 0.05$) or age (Table 8, chi-square = 0.830; $p > 0.05$) between respondents at the Dental School versus those in private practices. For both the Dental School and private practices, more females visited an orthodontist for an initial visit than males. There was no significant difference in the reasons for a visit to a second orthodontist between patients who were surveyed at the Dental School and at private practices when comparing the following reasons for the second visit: cost of treatment, treatment plan, and distance to the other office; a response of "relapse" and "other" were not included in this analysis because the number of responses to these reasons was too small for a sufficient sample size. There was no statistically significant difference in the reason for a visit to a second orthodontist between the two groups of patients. However, there was a tendency towards significance, with more Dental School patients seeking a second opinion because of the cost of treatment; and more private practice patients seeking a second opinion because of an unsatisfactory treatment plan at the initial provider's office (Table 9, chi-square = 3.614; $p = .164$). It should be noted that patients had the option to choose more than one

reason that they were visiting a second orthodontist. There was a significant difference in ethnicity between respondents surveyed at the Dental School and respondents surveyed in private practices (Table 10, chi-square = 11.594; $p \leq 0.01$). There were significantly more Caucasians seeking care in private practices than at the Dental School, which had significantly more African Americans. The number of patients responding as “Hispanic”, “Asian”, or “Other” were too small for a definite conclusion. Responses for other ethnicities included: Black, South Asian, Ethiopian, North African, and Indian. There was no significant difference in the level of schooling between respondents surveyed at the Dental School and respondents surveyed in private practices (Table 11, chi-square = 3.102; $p > 0.05$). In the response to the number of magazines read, the assumptions of chi-square were not met when all 5 levels were used. Therefore, the groups were combined into 0, 1-2, and 3-4 magazines read. There were significantly more respondents in private practice that read 3-4 magazines than at the Dental School, and there were significantly more respondents in the Dental School that read zero magazines than in private practice (Table 12, chi-square = 7.740; $p \leq 0.05$).

Table 7. Gender distribution in patients seeking care at the University of Maryland Dental School versus private practices in the Baltimore/Washington, D.C. area

Place of care	Gender	
	Male (%)	Female (%)
Dental School	24 (38%)	39 (62%)
Private Practice	26 (38%)	43 (62%)

chi-square = 0.002; $p > 0.05$

Table 8. Age of patients seeking care at the University of Maryland Dental School versus private practices in the Baltimore/Washington, D.C. area

Place of care	Age		
	14-18 (%)	19-30 (%)	31-50 (%)
Dental School	28 (44%)	14 (22%)	21 (33%)
Private Practice	29 (42%)	20 (29%)	20 (29%)

chi-square = 0.83; $p > 0.05$

Table 9. Reason for a visit to a second orthodontist for patients seeking care at the University of Maryland Dental School versus private practices in the Baltimore/Washington, D.C. area

Place of care	Reason for second visit*		
	Cost of Treatment (%)	Treatment plan (%)	Distance to other office (%)
Dental School	17 (63%)	5 (19%)	5 (19%)
Private Practice	5 (33%)	6 (40%)	4 (27%)

chi-square = 3.614; $p = 0.164$

*The following reasons for a second visit were dropped because of insufficient sample size in these groups: "relapse" and "other"

Table 10. Ethnicity of respondents completing the survey at the University of Maryland Dental School versus private practices in the Baltimore/Washington, D.C. area

Place of care	Ethnicity*			
	Caucasian (%)	African American (%)	Hispanic (%)	Asian (%)
Dental School	16 (28%)	30 (53%)	4 (7%)	7 (12%)
Private Practice	31 (48%)	15 (23%)	9 (14%)	9 (14%)

chi-square = 11.594; $p \leq 0.01$

*Respondents had the opportunity to answer their ethnicity as "other". These responses were excluded from this table due to insufficient sample size and responses are listed under the results section of this paper.

Table 11. Level of schooling of respondents completing the survey at the University of Maryland Dental School versus private practices in the Baltimore/Washington, D.C. area

Place of care	Level of schooling					
	Have not started high school (%)	Have not completed high school (%)	High school graduate (%)	Have completed some college (%)	Have completed a Bachelor's Degree (%)	Have completed some Postgraduate education or Postgraduate degree (%)
Dental School	6 (10%)	16 (26%)	10 (16%)	11 (18%)	7 (11%)	12 (19%)
Private Practice	7 (11%)	14 (21%)	9 (14%)	8 (12%)	14 (21%)	14 (21%)

chi-square = 3.102; p >0.05

Table 12. Number of magazines read by respondents completing the survey at the University of Maryland Dental School versus private practices in the Baltimore/Washington, D.C. area

Place of care	Number of magazines read*		
	0 (%)	1 to 2 (%)	3 to 4 (%)
Dental School	19 (50%)	16 (42%)	3 (8%)
Private Practice	12 (27%)	20 (44%)	13 (29%)

chi-square = 7.740; p ≤ 0.05

*The assumption of chi-square was not met when all levels were analyzed individually. Therefore groups were combined into the following: 0, 1-2, and 3-4 magazines read.

Table 13 shows the differences in the chief complaint between respondents surveyed at the Dental School and respondents surveyed in private practices (Table 13, chi-square = 10.303; p = 0.067). Dental School patients were more likely to have a chief complaint of “overbite”, while private practice patients were more likely to have a chief complaint of crowding; this result approached significance. The total number of responses for this question was greater than the number of patients completing the survey since patients were allowed to choose more than one chief complaint. The patient’s chief complaint was also examined from two other aspects. Table 14 evaluated the reason the

patient was seeking orthodontic care; this table excluded “Dentist Recommendation” because with this chief complaint, the patient may not perceive that he or she needed orthodontics. In this analysis, the difference in the patient’s stated chief complaint approached significance (Table 14, chi-square = 9.342; p = 0.053). As in Table 13, the total number of responses for this question was greater than the number of patients completing the survey instrument since patients were allowed to choose more than one chief complaint.

Table 13. Chief Complaint of respondents completing the survey at the University of Maryland Dental School versus private practices in the Baltimore/Washington, D.C. area

Place of care	Chief Complaint*					
	Crowding (%)	Spacing (%)	Crooked Teeth (%)	Underbite (%)	Overbite (%)	Dentist Recommendation (%)
Dental School	21 (16%)	25 (19%)	24 (18%)	4 (3%)	29 (22%)	28 (21%)
Private Practice	33 (29%)	16 (14%)	26 (23%)	6 (5%)	15 (13%)	19 (17%)

chi-square = 10.303; p = 0.067

*Chief complaint of "other" was not included because of insufficient sample size in these groups.

**Patient could have answered more than one response; this is why there are more responses than there are patient who completed the survey

Table 14. Chief complaint of respondents completing the survey at the University of Maryland Dental School versus those in private practices in the Baltimore/Washington, D.C. area

Place of care	Chief Complaint*				
	Crowding (%)	Spacing (%)	Crooked Teeth (%)	Underbite (%)	Overbite (%)
Dental School	21 (20%)	25 (24%)	24 (23%)	4 (4%)	29 (28%)
Private Practice	33 (34%)	16 (16%)	26 (27%)	6 (6%)	15 (16%)

chi-square = 9.342; p = 0.053

*A chief complaint of "other" was not included because of insufficient sample size in these groups. A chief complaint of "dentist recommendation" (which was included in Table 14) was excluded from this table because this was not a patient perceived problem.

**Patients could have answered more than one response; this is why there are more responses than there are patients who completed the survey

Additionally, the source of a patient’s awareness of a problem requiring orthodontics was analyzed (Table 15); this determined whether the patients were internally or externally motivated to see an orthodontist. In this table, a patient was categorized as having one or more self-perceived chief complaints (crowding, spacing, crooked teeth, underbite, or overbite), a dentist identified chief complaint (dentist recommendation), or both a self-perceived and a dentist identified chief complaint. Patients at the Dental School were more likely to seek orthodontic care because of a dentist identified chief complaint, and patients in private practice were more likely to seek orthodontic care because of a self-perceived chief complaint (crowding, spacing, crooked teeth, underbite, or overbite) (Table 15, Fisher’s exact test; p = 0.028). It should be noted, however, that the sample size for those responding to an external chief complaint was small. Only one respondent in private practice had solely a dentist identified chief complaint and only seven respondents in the Dental School had solely a dentist identified chief complaint. Therefore, these results should be considered with

some caution. While patients in the Dental School and in private practice both visited the orthodontist for self-perceived chief complaints, those in private practice were much more likely to do so (72% of patients in private practice versus 54% of patients at the Dental School).

Table 15. Patient self-awareness of a problem requiring treatment versus dentist recommendation

Place of care	Chief Complaint		
	Patients perceiving a problem requiring orthodontics (%)	Dentist Recommendation (%)	Patients perceiving a problem with orthodontics AND Dentist Recommendation (%)
Dental School	33 (54%)	7 (12%)	21 (34%)
Private Practice	48 (72%)	1 (1%)	18 (27%)

Fisher's exact test; $p = 0.028$

*A patient was noted as perceiving a problem requiring orthodontics if the patient responded "yes" to any of the following categories of chief complaint: "Crowding", "Spacing", "Crooked Teeth", "Underbite", and "Overbite"

Knowledge of Manufacturer's claims

Patient's knowledge of manufacturer's claims was evaluated in the following manner: each manufacturing company has made multiple claims that were included in the survey instrument (Invisalign[®] made four claims, Damon[®] made ten claims, Six Month Smiles[®] made five claims, and Snap-On Smile[®] made two claims). If the patient's response was in accordance with the claim made by the manufacturer, it was assumed that the patient had knowledge of the claim.

There was no significant difference in those patients at the Dental School versus those in private practice who responded to at least one manufacturer's claim (Table 16,

chi-square = 0.255; $p > 0.05$). The majority of people didn't respond questions relating to manufacturer's claims (55%), while 45% of patients knew enough about a manufacturer's claims to respond.

Table 16. Respondents that answered at least one question about manufacturer's claims

Place of care	Response rate	
	Patient responses to at least one manufacturer's claim (%)	Patient did not respond to any manufacturer's claims (%)
Dental School	57 (48%)	63 (52%)
Private Practice	53 (43%)	69 (57%)
Total responses	110 (45%)	132 (55%)

chi-square = 0.255; $p > 0.05$

Differences in knowledge of manufacturer's claims were evaluated by gender, age, ethnicity, and place of care (Table 17). There was no significant difference in knowledge of manufacturer's claims between males and females ($F = 2.122$; $p = 0.148$). Therefore, gender was combined within the two sites. The difference in knowledge of manufacturer's claims between different age groups was significant ($F = 3.954$; $p = 0.022$). In this case, a test of Homogeneity of Variance ($p = 0.014$) showed that the variability was not equal. Therefore, a Kruskal-Wallis ANOVA by ranks was used to determine which age groups differed statistically ($H = 10.778$; $p = 0.005$). Those patients age 14-18 (mean rank of 54.40) had significantly less knowledge of manufacturer's claims than those age 19-30 (mean rank of 78.03) and those age 31-50 (mean rank of 71.87). Responses were combined from the two sites because there were no differences in age groups between these two populations of patients. There was no difference in amount of knowledge of claims between the different ethnicities ($F = 0.446$; $p = 0.815$). Finally,

there was no significant difference in knowledge of manufacturer's claims between respondents seeking care at the Dental School versus those seeking care at private practices ($F = 0.571$; $p = 0.451$).

Table 17. Differences in knowledge of manufacturer's claims, knowledge of Invisalign[®]'s claims, and desirability for Invisalign[®] between gender, age groups, ethnicities, and place of care

	N	$\bar{x} \pm SD$	F/ H*	p
Knowledge of all Manufacturer's Claims				
Gender				
Male	50	1.62± 2.381	2.122	0.148
Female	81	2.32± 2.841		
Age*				
14-18	56	1.32± 2.297	10.778*	0.005
19-30	34	2.41± 2.091		
31-50	31	2.76± 3.352		
Ethnicity				
Caucasian	47	2.26± 2.885	0.446	0.815
African American	45	2.04± 2.779		
Hispanic	12	1.58± 2.610		
Asian	16	2.44± 2.529		
Other	7	1.43± 1.902		
Place of Care				
Dental School	63	2.24± 2.939	0.571	0.451
Private Practice	68	1.88± 2.441		

Table 17 continued

Knowledge of Invisalign®'s Claims				
Gender				
Male	50	1.20± 1.678	1.658	0.2
Female	81	1.58± 1.619		
Age*			10.058*	0.007
14-18	56	0.93± 1.463		
19-30	34	1.97± 1.714		
31-50	41	1.68± 1.665		
Ethnicity			0.892	0.489
Caucasian	47	1.72± 1.716		
African American	45	1.20± 1.590		
Hispanic	12	1.00± 1.477		
Asian	16	1.75± 1.653		
Other	7	1.43± 1.902		
Place of Care			0.618	0.433
Dental School	63	1.32± 1.574		
Private Practice	68	1.54± 1.714		
Desirability for Invisalign®				
Gender				
Male	50	2.3±3.536	2.721	0.101
Female	81	3.41±3.652		
Age*			9.49*	0.009
14-18	56	1.79±2.807		
19-30	34	3.79±3.788		
31-50	41	3.88±4.100		
Ethnicity			0.383	0.859
Caucasian	47	3.26±3.692		
African American	45	2.84±3.925		
Hispanic	12	2.17±3.157		
Asian	16	3.56±3.483		
Other	7	2.43±3.047		
Place of Care			0.03	0.863
Dental School	63	2.90± 3.481		
Private Practice	68	3.01± 3.791		

*When comparing age groups, a test for Homogeneity of Variance ($H = 0.001$) showed that variability was not equal for all groups. Therefore, a Kruskal-Wallis ANOVA by ranks was run in order to determine whether a significant difference existed between age groups. ANOVA is designated by an F, while a Kruskal-Wallis ANOVA is designated by an H.

Knowledge of Invisalign®'s claims

Differences in patient awareness of Invisalign's® claims were evaluated by gender, age, ethnicity, and place of care (Table 17). There was no difference in knowledge of Invisalign's® claims between males and females ($F = 1.658$; $p = 0.200$). Gender was combined between the two sites because there were no differences in gender distribution between these two groups. The difference in knowledge of Invisalign's® claims between different age groups was significant ($F = 5.236$; $p = 0.007$), and a test of Homogeneity of Variance = 0.007 showed that the variability was not equal. Therefore a Kruskal-Wallis ANOVA by ranks was used to determine which age groups differed statistically. There was a significant difference in the respondent's knowledge of Invisalign's® claims between age groups ($H = 10.058$; $p = 0.007$). Those age 14-18 (mean rank of 55.20) had significantly less knowledge of Invisalign's® claims than those age 19-30 (mean rank of 78.34) and those age 31-50 (mean rank of 70.52). Despite the fact that there were more African American patients seeking care at the Dental School and more Caucasian patients seeking care in private practice, there was no difference in the amount of knowledge of Invisalign's® claims between these two ethnicities ($F = 0.892$; $p = 0.489$). Finally, there was no significant difference in the awareness of Invisalign's® claims between respondents seeking care at the Dental School versus those seeking care at private practices ($F = 0.618$; $p = 0.433$).

Table 18 shows the differences in responses between the two places of care with regard to specific Invisalign® claims. Significantly more respondents in private practices were more knowledgeable of Invisalign's® claim that "It is easier to brush with

Invisalign[®]” as well as their claim that “It is easier to floss with Invisalign[®]” when compared to conventional braces.

Table 18. Respondents’ knowledge of Invisalign’s[®] claims

Claim made by Invisalign [®]	Place of Care	Respondents (%) that answered with Invisalign [®] 's claim	Respondents (%) that answered opposite of Invisalign [®] 's claim	Type of statistical test	Statistical result	P
It is easier to brush with this treatment	Dental School	18 (37%)	6 (100%)	x ²	6.317	≤ 0.05
	Private Practice	31 (63%)	0 (0%)			
It is easier to floss with this treatment	Dental School	20 (47%)	6 (17%)	x ²	6.611	≤ 0.05
	Private Practice	23 (53%)	30 (83%)			
This treatment costs less	Dental School	18 (46%)	3 (50%)	Fisher's	—	1.00
	Private Practice	21 (54%)	3 (50%)			
This treatment is more visible	Dental School	26 (48%)	1 (50%)	Fisher's	—	1.00
	Private Practice	28 (52%)	1 (50%)			

Favorability of Manufacturer’s Claims

By evaluating the number of times a patient responded true to a positive statement or false to a negative statement, we determined how desirable Invisalign[®] treatment was to each respondent. Of the 57 patients at the Dental School that responded to at least one manufacturer’s claim, 33 of them (41%) responded to at least one statement regarding Invisalign[®], while only 18 (22%), 14 (17%), and 16 (20%) responded to at least one statement regarding Damon[®], Six Month Smiles[®], and Snap-On Smile[®], respectively. Of the 53 respondents in private practice that responded to at least one manufacturer’s claim, 38 of them (70%) responded to at least one statement regarding Invisalign[®], while only 7

(13%), 5 (9%), and 4 (7%) responded to at least one statement regarding Damon[®], Six Month Smiles[®], and Snap-On Smile[®], respectively (see Table 19). Both patients at the Dental School and in private practice were more likely to respond to questions relating to Invisalign[®], but patients in private practice did to a greater degree (70% versus 41%). There were, however, significantly more Dental School patients that responded to statements about Damon[®], Six Month Smiles[®], and Snap-On Smile[®] (Table 19, chi-square = 11.724; $p \leq 0.01$).

Table 19. Patient responses to at least one statement to each type of treatment

Place of care	Number (%) of patients responding to at least one claim			
	Invisalign	Damon	Six Month Smiles	Snap-On Smiles
Dental School	33 (41%)	18 (22%)	14 (17%)	16 (20%)
Private Practice	38 (70%)	7 (13%)	5 (9%)	4 (7%)

chi-square = 11.724; $p \leq 0.01$

Because of the low response rate to statements regarding Damon[®], Six Month Smiles[®], and Snap-On Smile[®], only the desirability of Invisalign[®] was statistically analyzed.

Desirability of Invisalign[®]

Differences in the desirability of Invisalign[®] were evaluated by gender, age, ethnicity, and place of care (Table 17). The difference in the desirability for Invisalign[®] between males and females approached significance ($F = 2.721$; $p = 0.101$), where females more than males tended to consider Invisalign[®] more desirable. Males and females were grouped for both populations because there were no gender differences in the responses between these two groups. The difference in desirability of Invisalign[®]

between different age groups was significant ($F = 5.488$; $p = 0.005$). A test for Homogeneity of Variance ($p = 0.001$) showed that variability was not equal in all groups. Therefore, a Kruskal-Wallis ANOVA by ranks was run in order to determine where the difference existed between age groups. There was a significant difference in desirability for Invisalign[®] between the three age groups ($H = 9.490$; $p = 0.009$) Those patients age 14-18 (mean rank of 54) thought that Invisalign[®] was significantly less desirable than those age 19-30 (mean rank of 73.93) and those age 31-50 (mean rank of 74.59). Despite the fact that there are more African American patients seeking care at the Dental School and more Caucasian patients seeking care in private practice, there was no difference in the desirability of Invisalign[®] between the two ethnicities ($F = 0.383$; $p = 0.859$). Results for males and females were combined for both the Dental School and private practice because there were no significant differences in age between these two patient populations. Finally, there was no significant difference in the desirability of Invisalign[®] between those at the Dental School versus those seeking care at private practices ($F = 0.030$; $p = 0.863$).

Table 20 shows the statements that differed the most in favorable responses between patients responding at the Dental School versus private practice. There was a significant difference when responding to the statement “It is easier to brush with this treatment”; patients in private practice were more likely to respond to this statement in a favorable manner (Fisher’s exact test = 0.017).

Table 20. Respondents that answered favorably towards Invisalign®'s claims

Claim made by Invisalign®	Place of Care	Respondents (%) that answered positively towards Invisalign®'s claim	Respondents (%) that answered negatively towards Invisalign®'s claim	Type of statistical test	Statistical result	p
It is easier to brush with this treatment	Dental School	24 (44%)	6 (100%)	Fisher's	—	0.017
	Private Practice	31 (56%)	0 (0%)			
This treatment is more likely to give you the smile that you want	Dental School	15 (60%)	3 (33%)	Fisher's	—	0.2497
	Private Practice	10 (40%)	6 (67%)			
This treatment requires less office visits	Dental School	8 (36%)	7 (59%)	χ^2	0.76	> 0.05
	Private Practice	14 (64%)	5 (42%)			
This treatment is more likely to give you a broader smile	Dental School	5 (38%)	6 (60%)	χ^2	0.365	> 0.05
	Private Practice	8 (62%)	4 (40%)			
This treatment is faster	Dental School	8 (40%)	12 (55%)	χ^2	0.401	> 0.05
	Private Practice	12 (60%)	10 (45%)			
Total number of positive responses to treatment	Dental School	183 (45%)	82 (50%)	χ^2	0.811	> 0.05
	Private Practice	220 (55%)	82 (50%)			

DISCUSSION

Number of patients surveyed

It was not possible to obtain the 300 patient surveys needed to reach a power of 0.80 in the time allotted for the study. Because of this, results approaching significance were also examined, as these may have been significant if there was a larger sample was surveyed.

Power may not have been reached for a few reasons. The first is that there was a limited time for new patients to complete the instrument before seeing the orthodontist; this may be especially true for private practice orthodontics. Offices may pride themselves on efficiency, and like to start the initial appointment as soon as possible after the patient enters the office. In a busy office, the front desk may forget to distribute the survey instrument as part of the new patient packet. Also, fewer patients may have been surveyed because many patients begin seeing the orthodontist when they are younger than 14, since many orthodontists encourage the start of treatment either in the mixed dentition. Because of this, those patients would not have completed surveys, limiting our sample size. Finally, patients may refuse to complete the survey instrument, since participation in this study was optional.

Discussion of demographic differences

There were no demographic differences between the respondents surveyed at the Dental School versus respondents surveyed in private practices in regard to gender, age, or level of schooling. In this study, more females visited the orthodontist for an initial

visit (62%) versus males (38%). Females may be more conscious of esthetics or function and therefore may seek orthodontic care more than males. Parents of younger female patients may be more concerned about the esthetics or function of their daughters and may be more likely seek orthodontic care for them than for their sons.

When comparing the reasons that a respondent gave for visiting a second orthodontist, there was a trend by those at the Dental School to seek a second opinion because of the cost of treatment, and for those in private practice to seek a second opinion because of an unsatisfactory treatment plan at the first office. These trends may have reached statistical significance if this study were replicated with a larger sample size.

There was a difference in ethnicity between respondents seeking treatment at the Dental School versus those seeking treatment in private practice. Respondents in private practice were more likely to be Caucasian, while respondents at the Dental School were more likely to be African American. This may be due to practice location, since more African American patients are located near the Dental School, and the cost of treatment. The results from this study mirror population statistics from the United States Census Bureau in 2012 (<http://quickfacts.census.gov/qfd/states/24/24510.html>, Accessed 16 July 2013): while 63.6% of the population in Baltimore City is Black or African American, only 30.0% of the population in Maryland is Black or African American.

There were significantly more respondents in private practices who read 3-4 magazines regularly, while there were significantly more respondents in the Dental School that read zero magazines regularly. This could be due a number of reasons. Since differences in the cost of treatment as a reason for seeking an initial appointment at a

second orthodontist approached statistical significance, those patients seeking care in private practices may have more disposable income to buy magazines than those at the Dental School. Since the demographic difference found between the patient population at the Dental School versus the patient population in private practices was ethnicity; there may be racial differences in the way that patients spend their leisure time. While there was no significant difference between the two patient populations in the other leisure parameters studied in this survey instrument (hours spent watching television and hours surfing the internet for leisure), Caucasian patients may allot more of their time to reading magazines, while more African American patients may devote more time to other activities not listed in this survey instrument. This difference in the number of magazines read regularly cannot be attributed to differences in the level of schooling between the two groups since there was no statistical difference in the level of schooling as shown in Table 11. Although patients in private practice are more likely to read 3-4 magazines regularly, the content of the magazines read did not increase their knowledge of Invisalign[®] nor the desirability for Invisalign[®] since there was no difference in either of these two parameters between patients seeking care at the Dental School versus private practice.

Differences in the chief complaint between patients at the Dental School and private practice approached significance; respondents at the Dental School had a chief complaint of overbite, while respondents in private practices were more likely to seek care for crowding. The differences in the number of patients with a chief complaint of spacing at the Dental School versus the chief complain of crowding in patients in private practice could be due to a number of reasons. The first possibility is the difference in the

terminology that patients use to describe a perceived problem and the terminology the practitioner uses. Many patients will use the term “overbite”, when they actually mean maxillary protrusion; something that a practitioner would term “overjet”. The terminology used by patients and practitioners to articulate the other chief complaints; crowding, spacing, crooked teeth, and underbite; is the same for both patients and practitioners. Second, there are differences in racial norms for skeletal, dental, and soft tissue relationships. Since there is a statistically significant difference in ethnicity between patients seeking care at the Dental School versus private practice, racial skeletal and dental relationships may be different between the two groups. Therefore, patients in these two groups may have different malocclusions and consequently, different chief complaints.

There was also a significant difference between patients coming for an initial consultation because of a self-perceived problem requiring orthodontics and a patient presenting because of a dentist identified problem; or those with a combination of both internal and external chief complaints. Patients at the Dental School were significantly more likely to visit the orthodontist due to a recommendation from a dentist. Patients in private practice were significantly more likely to visit an orthodontist based on their own desire. This may be due to a number of reasons. First, patients in private practice may have more disposable income and may choose to use these resources to improve their occlusion. Patients at the Dental School may have fewer financial resources and may only visit an orthodontist if a dentist thinks that orthodontics is necessary. There were also many patients that presented to the Dental School (34%) and private practice (27%) because of both internal and external motives.

There were no significant differences in the number of patients who answered at least one question regarding an alternative treatment type to conventional braces (patients who had responded true or false to at least one manufacturer's claim) at the Dental School versus the number of patients who answered at least one manufacturer's claim in private practice (see Table 16). This shows that understanding of manufacturer's claims was similar between respondents seeking care at the Dental School and those seeking care at private practices. Although a large percentage of respondents didn't respond to any statements about alternative treatment types (55%), there were a fairly large number of respondents (45%) who did indicate familiarity with at least one manufacturer's claim. Some respondents may not have responded to claims by manufacturers because they didn't feel confident enough comparing alternative treatments to conventional braces, they may not have had enough time before the start of their initial appointment, or they may have rushed to make sure they had completed the survey instrument before their appointment.

Differences in knowledge of manufacturer's claims

While there were similar numbers of patients who responded to at least one statement regarding Invisalign[®] at both the Dental School and in private practice, significantly more Dental School patients indicated a familiarity with Damon[®], Six Month Smiles[®] and Snap-On Smile[®]. This may be due to a number of reasons. Patients at the Dental School may be more knowledgeable about the alternative treatment methods of Damon[®], Six Month Smiles[®], or Snap-On Smile[®] because of potential differences in the types of treatment that orthodontic providers offer within Baltimore City. Additionally, there also may be more providers of Six Month Smiles[®] and Snap-On

Smile[®] in the city, so those patients living in the city may be more familiar with these treatment types.

Differences in knowledge of Invisalign[®]'s claims

It was hypothesized that there would be differences in familiarity with Invisalign[®]'s claims between gender, age, ethnicity, and place of care. While it was hypothesized that females would have more knowledge of Invisalign[®]'s claims than males, there was no difference found regarding knowledge of these claims between males and females. Although females responded more favorably about Invisalign[®] than males (as seen in previous section), they do not have more knowledge of those claims than males. Although males and females have similar knowledge of Invisalign[®]'s claims, males may have a more negative connotation to Invisalign[®] than females. This may be because males are less esthetically concerned than females.

We hypothesized that 19-30 year olds would have more knowledge of Invisalign[®] than 14-18 year olds and 31-50 year olds. We found that those ages 19-30 and those ages 31-50 were more knowledgeable about Invisalign's[®] claims than those ages 14-18 (they answered more questions in accordance with Invisalign's[®] claims). This may be because those patients age 14-18 play more of a passive role in their treatment options, while the patient's parent plays more of the active role in treatment decisions. These patients may also prefer conventional braces to alternative treatment options to fit in with the other children their age that also have braces, and so may not have sought more information regarding Invisalign[®] treatment. Those patients age 19-30 and 31-50 not only are more desirable towards Invisalign[®] but also had more knowledge of Invisalign[®]'s claims.

We hypothesized that there would be differences between different ethnicities and different places of care and patients' knowledge of Invisalign® claims. However, we did not find any differences between these demographics and patient's knowledge of claims.

Differences in acceptance of manufacturer's claims

There were a similar number of desirable responses to statements about Invisalign® between patients at the Dental School and patients in private practice, but patients at the Dental School responded more positively to more statements about Damon®, Six Month Smiles® and Snap-On Smile® than patients in private practice. There may be many reasons for this difference. The first is that patients might assume that Six Month Smiles® and Snap-On Smile® are treatments that can be completed in a shorter amount of time. These patients might associate shorter treatment times with a lower treatment cost. Since there was a trend for patients at the Dental School to seek treatment at the school based on cost, those patients surveyed at the Dental School may have responded more favorably to statements regarding Six Month Smiles® and Snap-On Smile® if they perceived these treatment types to be less expensive. Second, there may be racial differences in the social acceptability of conventional braces. If these differences in the social acceptability of braces exist, certain ethnicities may seek faster or more esthetic treatment types. Conversely, there may be some communities in which conventional braces are seen in a positive light, and these patients might not think faster or more esthetic treatments, such as Six Month Smiles® or Snap-On Smile®, are more desirable. There may be an association with terms such as “Snap-On Smile®” and “grills” or “fronts”, which is jewelry worn over the anterior teeth; this might be more attractive to some patient populations. Conversely, a removable treatment, such as is implied with

Snap-On Smile[®], may be undesirable to some patient populations that may view removable appliances as cheap. Finally, patients may perceive that Six Month Smiles[®] and Snap-On Smile[®] are more effective at treating certain problems more than others. If patients perceive that these two treatment types are more effective at correcting overbite and less effective at correcting crowding, the groups of patients at the Dental School whose chief complaint was more likely to be overbite might respond more favorably to these treatment types because they believe that they will solve their issue effectively.

Differences in the desirability of Invisalign[®]

The difference in the desirability of Invisalign[®] between males and females approached significance, with females more than males desiring of Invisalign[®]. This may be because females may be more receptive to advertising regarding cosmetic procedures and may be more esthetically concerned than males.

Those patients age 14-18 desired Invisalign[®] significantly less than those age 19-30 or those age 31-50. This may be because patients age 14-18 may prefer the look of conventional braces, and they feel that it is a more age acceptable to be wearing braces. Patients age 19-30 and 31-50 may also be more esthetically conscious than those age 14-18. Older patients are also more likely to hold a professional career, and less noticeable treatment might be very important to them.

It was hypothesized that there would be differences in the desirability of Invisalign[®] between patients of different ethnicities as well as between patients seeking care at the Dental School versus those seeking care in private practices. However, there

were no differences found in how much patients desired Invisalign[®] treatment between patients of these two demographic groups.

Limitations

Ideally, this survey instrument would have been personally delivered to each patient by a researcher involved in the study in order to explain the instrument and answer any questions that patients and their parents might have had. Logistically, researchers could not distribute each study, and the task was delegated to the front desk personnel of each office.

Initially, it was hoped to survey 300 patients during the four months the survey instrument was distributed. Distribution was discontinued after four months so as not to intrude on offices, and 63 patients at the Dental School and 69 patients in private practices were surveyed for a total of 132 respondents.

Another limitation to the study was the terminology used to describe treatment. The term “braces” was used, and assumed that patients know what “braces” are, and that all patients’ perceptions of conventional braces are the same. Some older patients may perceive braces as appliances with stainless steel bands encircling every tooth, instead of the more modern brackets that are bonded to each tooth. Older patients may also perceive braces to mean heavier forces from heavier archwires.

Those patients under the age of 14 were excluded because those patients were thought to be less likely to have knowledge of, and be influenced by, manufacturer’s

claims. This eliminated many patients, especially in private practices where early treatment is often done before the age of 14. Those patients older than 50 were also excluded, which eliminated other patients seeking care. These results may or may not be different if these age groups were included.

Suggestions for further research

Further investigation with a larger sample size would improve the accuracy of the study. This sample was limited to patients from the Orthodontic Department of the University of Maryland Dental School, and patients at private orthodontic offices in the Baltimore/Washington, D.C. areas. Perceptions of this group of patients may not be the same as perceptions of patients in other areas of the country. People's personalities may be different in different areas of the country, and they may be exposed to different advertisements. To validate patient perceptions in other areas of the United States or abroad, similar survey instruments should be administered to determine if differing patient perceptions are based on location-specific environmental influences. It would also be interesting to survey general dentists and pediatric dentists to determine their perceptions of the treatments investigated, and whether perceptions of the referring practitioner influences the perception of the new orthodontic patient.

All media or social influences were not explored; there may be other factors that influence patient perceptions that we did not consider, such as advertisements on specific websites such as Facebook or YouTube. It would be interesting to investigate additional sources where patients could obtain information regarding orthodontic treatment types.

While education level was explored in this instrument, which may correlate with socioeconomic status, no questions were asked about income level of the patients due to the sensitivity of the question and out of respect for the orthodontist office. Questions regarding income level may have further colored our results. Patients with lower incomes may opt for treatment options that they think cost less, while patients with higher incomes may opt for treatment options that are of higher quality.

This study attempted to determine a patient's knowledge of various manufacturers' claims; it also determined the desirability for these treatment types. The source from which the patient learned about different treatment types was addressed indirectly by this survey; this is very important information and it is suggested that further research be done in this area. Information regarding the source of knowledge of alternative treatment methods was included in the second pilot study, but removed from the final study due to constraints on instrument length. By determining this information, orthodontists and other dental professionals would be able to educate the public on orthodontic issues through the same venues by which information is successfully being conveyed.

Clarity of chief complaint, along with a larger sample size, might reveal additional differences in the definition of terms used among different groups of patients. A patient's chief orthodontic complaint could also be further explored. If this survey instrument were administered again, the definition of "overbite" versus "overjet" could be explained, as patients definition of overbite may not be the same as the practitioners definition of overbite.

For children under the age of 18, parents or guardians legally make health decisions for the children. If this survey was distributed again, both the parent and the child could complete the survey instrument. This protocol was not done in this study so as to concentrate on patients' knowledge of orthodontics, not their parents. Even though the parent may have a vested interest and opinion and make the ultimate treatment decision, it was the minor who was the patient. It is important for the orthodontist to know the patient's opinion about treatment, even if the patient isn't the one ultimately making the decision, since patient cooperation throughout treatment is necessary for treatment success.

CONCLUSIONS

While orthodontic patients used to receive information about their treatment primarily through their orthodontist, there may be a shift in the way in which patients obtain information, as well as in the information that they receive. This study sought to determine how much patients knew about manufacturer's claims of alternative orthodontic treatments and their level of positivity towards those treatments.

There were some demographic differences between patients seeking care at the Dental School and patients seeking care in private practices. There were significantly more African American respondents seeking care at the Dental School with significantly more Caucasian respondents seeking care in private practices. There were significantly more respondents in private practice that read 3-4 magazines regularly than in the Dental School. Patients at the Dental School were more likely to seek a consult from a second orthodontist because of the cost of treatment, but this was only a trend. Patients at the Dental School were more likely to express a chief complaint of spacing and overbite, while patients in private practice were more likely to express a chief complaint of crowding and "underbite".

There were some differences in patient familiarity with Invisalign's[®] claims; those respondents age 14-19 had less knowledge of Invisalign's[®] claims than those 19-30 or those 31-50. Finally, there was very little familiarity with claims made for Damon[®], Six Month Smiles[®], and Snap-On Smile[®]; because of this, no analyses were performed for this data.

There were also some differences in the desirability for Invisalign® treatment between different groups of patients. Those respondents age 14-18 were significantly less desiring of Invisalign® than those 19-30 and those 31-50. Females more than males were more desiring of Invisalign®; this result approached significance.

In summary, there were differences in ethnicity, the number of magazines read, and in chief complaint between patients seeking care at the Dental School versus in private practice; those patients age 14-18 had less knowledge of Invisalign®'s claims and considered Invisalign® less desirable than those age 19-30 and 31-50.

Manufacturers have been directly marketing to patients, providing them with information about different orthodontic treatment techniques. Although the amount that manufacturers budget toward advertising and marketing is protected by the manufacturers, we found that Align Technologies marketing techniques have provided patients with more knowledge of Invisalign®; if other manufacturer's marketed as Invisalign® did, they may be more successful in educating potential patients regarding their treatment technique. While Invisalign® may be better marketed to the patients, other treatment types may be better marketed toward the practitioner.

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